GENERAL LIBRARY
JUL 16 1920
UNIV. OF MICH.

SCIENCE

NEW SERIES
VOL. LII, No. 1333

FRIDAY, JULY 16, 1920

SINGLE COPIES, 15 CTS.
ANNUAL SUBSCRIPTION, $6.00

for every requirement

Bausch and Lomb Microscopes

The Accepted Standard

During the last fifty years Bausch & Lomb have designed and built microscopes to fill every possible requirement.

And when you buy a Bausch & Lomb Microscope you obtain an instrument having every optical refinement and mechanical improvement demanded by the practices of modern microscopy.

Write for our new catalog which fully describes the advanced improvements made in various models.

Bausch & Lomb Optical Co.

409 ST. PAUL STREET ROCHESTER, N.Y.

Leading American makers of Photographic Lenses, Microscopes, Projection-Apparatus (Balopticons), Ophthalmic-Lenses and Instruments, Photomicrographic Apparatus, Range-Finders and Gun-Sights for Army and Navy, Searchlight Reflectors, Stereo-Prism Binoculars, Magnifiers, and other high-grade Optical Products

Monographs in Experimental Biology and General Physiology

Edited by JACQUES LOEB, Rockefeller Institute
T. H. MORGAN, Columbia University, and W. J. V. OSTERHOUT, Harvard University

Published Volumes

FORCED MOVEMENTS, TROPISMS AND ANIMAL CONDUCT
By JACQUES LOEB. M.D., PH.D., SC.D.
Member of the Rockefeller Institute for Medical Research.
42 Illustrations. $2.50 net.

THE ELEMENTARY NERVOUS SYSTEM
By G. H. PARKER, SC.D.
Professor of Zoology, Harvard University. 53 Illustrations.
$2.50 net.

THE PHYSICAL BASIS OF HEREDITY
By T. H. MORGAN,
Columbia University. 117 Illustrations. $2.50 net.

INBREEDING AND OUTBREEDING:
Their Genetic and Sociological Significance.
EDWARD M. EAST, Ph.D. — Bussey Institution, Harvard University
DONALD F. JONES, SC.D. — Connecticut Agricultural Experiment Station

THE NATURE OF ANIMAL LIGHT
By PROF. E. NEWTON HARVEY
Princeton University. 35 Illustrations. $2.50 net.

Other volumes in preparation.
Send for circular of the entire series.
Correspondence Solicited.

J. B. LIPPINCOTT COMPANY
PUBLISHERS PHILADELPHIA

Country Life Education Series

Types and Breeds of Farm Animals

(Revised Edition)

By CHARLES S. PLUMB

Longer than the old edition by 224 pages, this book has been brought up-to-date as regards all records and data. A large amount of space is devoted to discussion of the different breeds, to families of note and to individual animals.

GINN AND COMPANY
70 Fifth Avenue NEW YORK

Publications of Carnegie Institution of Washington

The publications of the Institution now number over 400 volumes, the subjects including Anatomy, Archæology, Astronomy, Botany, Chemistry, Climatology, Economics and Sociology, Embryology, Experimental Evolution and Heredity, Engineering, Folk-Lore, Geology, History, International Law, Literature, Mathematics, Medicine, Nutrition, Paleontology, Philology, Physics, Stereochemistry, Terrestrial Magnetism, Zoology. Classified and descriptive lists will be sent postpaid on application.

5. BURNHAM, S. W. General Catalogue of Double Stars within 121° of the North Pole. Quarto, 2 vols. . . $14.00
Vol. 1, The Catalogue, LV+256 (256a-256r) pages.
Vol. 2, Notes to the Catalogue, VIII+257-1086 pages.
115. BOSS, LEWIS. Preliminary General Catalogue of 6188 Stars for the Epoch 1900, including those visible to the naked eye and other well-determined Stars. Quarto, XXXVII+345 pages. (Out of print) $7.00
115. Reprint of the above, with list of Errata in First Edition $3.50
246. Albany Zone Catalogues for the Epoch 1900. Quarto, XXIII+249 pages $5.00
BOSS, LEWIS—Catalogue of 8276 Stars between 20° and 41° of South Declination.
ROY, ARTHUR J.—Catalogue of 2800 Stars between 2° of South and 1° of North Declination.
138. ADAMS, WALTER S., assisted by JENNIE B. LASBY. An Investigation of the Rotation Period of the Sun by Spectroscopic Methods. Quarto, III+132 pages, 2 plates, 5 text figures $3.00
235. HALE, GEORGE E. Ten Years' Work of a Mountain Observatory: A Brief Account of the Mount Wilson Solar Observatory. 12mo, 99 pages, 65 text figures.
In paper cover, 50 cents; in cloth, 75 cents.
250. KNOBEL, EDWARD B. Ulugh Beg's Catalogue of Stars, revised from all Persian Manuscripts existing in Great Britain, with a Vocabulary of Persian and Arabic Words. Quarto, 109 pages, 1 plate $2.00

All communications should be addressed to
CARNEGIE INSTITUTION OF WASHINGTON
WASHINGTON, D. C.

Ready Shortly

THE PHYSICS OF THE AIR

By WILLIAM J. HUMPHREYS, Ph.D.
Professor of Meteorological Physics, U. S. Weather Bureau

A rational and deductive treatise on the physics of the atmosphere. Of great value to meteorologists, physicists and the aviator.

650 pages, many illustrations, 8vo. Price $5.00

Address orders and inquiries to

THE FRANKLIN INSTITUTE
PHILADELPHIA, U. S. A.

The Ellen Richards Research Prize

of $1,000 is offered for award in the year 1921. Theses by women based on independent laboratory research are eligible for competition

For circulars of information and application blank, apply to Dr. Florence R. Sabin, Johns Hopkins Medical School, Baltimore, Maryland.

SCIENCE

FRIDAY, JULY 16, 1920

CONTENTS

The College Teacher and Research: PROFESSOR LEROY D. WELD 45

Waxy Maize from Upper Burma: DR. G. N. COLLINS 48

Physical Measurements in Psychology: DR. A. P. WEISS 51

General William C. Gorgas: SURGEON-GENERAL M. W. IRELAND 53

Scientific Events:—
The Annual Report of the Registrar General of England and Wales; The World's Production of Gold; Professor Van Beneden of Liége; The Rockefeller Institute for Medical Research 54

Scientific Notes and News 56

University and Educational News 59

Discussion and Correspondence:—
Intersexes in Drosophila and Different Types of Intersexuality: JULIAN S. HUXLEY. *The Origin of Oil:* CHESTER W. WASHBURNE. *The Causes and Prevention of After Corrosion on the Bores of Firearms:* WILBERT J. HUFF 59

Scientific Books:—
Comstock's Introduction to Entomology: DR. VERNON KELLOGG 61

Special Articles:—
"Physical Constants" pertaining to the Ocean: DR. GEORGE F. MCEWEN. *The Differential Staining of Plant Pathogen and Host:* DR. B. T. DICKSON 62

The American Association for the Advancement of Science:—
Section O—Agriculture: DR. JACOB G. LIPMAN 64

MSS. intended for publication and books, etc., intended for review should be sent to The Editor of Science, Garrison-on-Hudson, N. Y.

THE COLLEGE TEACHER AND RESEARCH[1]

IT is a part of the function of every progressive institution of learning, not only to impart knowledge to students, but to do its share in accumulating knowledge for the benefit of mankind. To this end, scientific research in some form is indispensable to the best attainment of a college.

It is far from my thought to place the importance of research on as high a plane as that of training character, but it is hoped that there may appear some elements in common to the two, and no lack of consistency between them.

It can hardly be doubted that there is such a thing as a research instinct. A small boy exhibits it when he picks to pieces a dead fly, or tries to make ink out of mud, or puts a firecracker in a glass bottle to see what will happen. Curiosity is an inseparable ingredient of the human make-up, and research is curiosity directed by a noble purpose and put to a noble service. There is something about the acquiring of first-hand knowledge that stimulates individuality and gives a sense of personal achievement. And with a person whose life and activities are chiefly intellectual, the exercise of this instinct is as essential to his progress as eating is to his physical welfare.

One of the sad privations in the life of a foreign missionary is said to lie in the fact that he is constantly giving out to those about him, without having the spiritual refreshment that would be afforded by association with kindred minds. He is constantly teaching religion to ignorant, undeveloped people, and longs for someone who will understand and sympathize with his point of view. Too often, the teacher of science in the small

[1] Address given before the physics luncheon at the Iowa Academy of Science, April 23, 1920.

college is an isolated missionary among barbarians who know not even his language, and who can give little inspiration to his particular work. And as the foreign missionary must refresh himself first-hand at the source of all spirituality, so ought the college scientist to get his needed inspiration by digging into Nature's secrets and striking for himself the fountains of scientific truth.

Too much can hardly be said by way of caution to college professors against growing "stale." Shut out from the intellectual communion which they crave by their virtual isolation from their own particular species (except at long intervals on such happy occasions as this); oppressed by a monotonous routine of hearing recitations, conducting quizzes, correcting papers and notebooks and attending faculty meetings; and oft-times discouraged by a lack of all evidence of appreciation, at least as expressed by any adequate compensation or equipment: what wonder is it that these men are prone to fall into the commonplace, to vegetate, as it were, and fail even to keep pace with the progress in their own fields? There is only one remedy. It is *action*. And research is action that extends to the very roots of the scientist's being (if, indeed, he be a true scientist at all), and regenerates his whole professional attitude.

There are, furthermore, certain very practical advantages to be gained from a reasonable activity in research. One can not engage in such work without becoming tolerably familiar with the field in which it lies, and with the subjects associated with it. It furnishes an incentive to more thorough study on the part of the teacher himself, and gives a mastery and a self-confidence in teaching, along these particular lines at least, that could hardly be gained otherwise. The professor of physics, for example, who has worked out some little line of inquiry connected with radio-activity, even though it be with the aid of a home-made electroscope housed in a tin can, and utilize no more expensive radio-active preparation than a cast-off Wellsbach mantle, has had first-hand experience with the obstinacy of electroscopes and the practical difficulties of radioactive experiments generally that will give him the feeling of knowing what he is talking about when it comes to teaching that part of his subject. The same circumstance gives the teacher the more complete confidence of his students and colleagues, who justly feel that a man who is making original contributions to his science is one who can be trusted to teach it with some authority. Nor is this feeling confined to the individual: it reflects credit upon the college and gives it character among scholastic institutions in such proportion as its researches are published and become known to the intellectual public.

There is also a still more direct benefit to the college whose professors are engaged in productive research in the laboratories of their own departments. Students like to see things. However reassuring may be the knowledge that their teachers have formerly studied and done research in some university or other, there is nothing so stimulating to their immediate interest as the opportunity to see research actually going on, to see new truth actually coming to light. The botanist who can beckon to his students to the microscope and say that here is a form of life never before described, or the geologist who can take his class to a rock exposure that disproves some prevalent theory of local geology, excites at once the interest and confidence of his pupils. No text-book statement is half so convincing. And the college student takes a measure of pride, and experiences a sort of awe, in the presence of what seems to him to be genius.

Can any one deny that the students in our hundreds of small colleges have as good a right to such advantages as the students of the few large universities of the land?

Now there seems to be an unfortunate impression among scientific people that research is practicable only with the elaborate equipment and in the surcharged atmosphere of the great university graduate school. It must be admitted that there are many research problems of which this is in a measure true. But research, like music, has its rôles, of which the minor ones have their own

peculiar importance and offer their own peculiar opportunities. If every musician aspired to play the pipe organ or to conduct a fifty-piece orchestra, it would indeed be an expensive and ambitious undertaking to become a musician. But some of the finest music is produced on the simplest instruments, or by the unaided voice; and it should be remembered likewise that successful research depends more upon the industry and personality of the man who engages in it than upon the apparatus which he may have at his disposal.

If college men are not recognized as research workers, it is because they do not produce; and if they do not produce, it is because they do not have it in them to do so, or else it is because they do not try.

The institution represented by the writer is not wealthy, but it is illustrative that, out of a dozen or more pieces of research in physics undertaken within as many years, only two have called upon any assistance whatever in the way of equipment from outside sources. Right-minded college authorities (and there are such) are not averse to making some reasonable provision for research work. I have observed that presidents and trustees gauge their appropriations largely by the confidence which they have in the man asking for equipment, in the wisdom and economy of his selections, in the uses to which he is likely to put the material purchased, and in the care which he is likely to take of it; and if they know that he will take every precaution to save the institution unwarranted expense, that fact will go a long way toward liberalizing their policy. Problems can be selected that depend upon diligence, care and skill, rather than upon elaborate apparatus.

A most encouraging circumstance also is the fact that there are great research agencies which have expressed themselves as only too glad to lend a hand in any worth-while problem that the college man may wish to enter upon. This is true of the great universities themselves; it is true of the National Research Council. To test this point, let any competent college scientist who genuinely wishes to do research work, but who lacks certain essential items of equipment, confer with the head of the appropriate department in this or any other graduate university, or make known his needs to the National Research Council at Washington, and discover how readily these institutions will give him, not only their material cooperation, but the best of their wisdom as well, in the problem to which he is addressing himself. The Research Council has even gone so far as to initiate a sort of bureau of exchange of research apparatus for the assistance of workers in just such cases. And the writer finds it difficult to express his appreciation of the ready liberality, and evidence of confidence, with which his own *alma mater* has supplied the somewhat heavy demands that some of his more recent work has made upon her resources.

A common plea among non-productive scientists is that they do not have time. That excuse is threadbare and in tatters. Men have time for what ever is worth while in the exercise of their powers. The amount of work a man can accomplish depends upon his determination and upon how well he has learned to systematize his day or his week. I am convinced that no college man, or university man either, can make real progress in research without setting apart a definite portion of his program for that exclusive purpose, and then sticking to it even to the extent of locking his doors, if necessary, against interruption while he is so engaged.

It often happens, however, that the worst intruder is one's own temptation to depart from his schedule. The research period arrives. There is a pile of test papers on his desk to be corrected, or a pile of ashes in his cellar to be carried out. Why not let the research go this week? After all, the research is only a side-issue. To minimize this, the writer has several times adopted the expedient of getting one or two college students to register for "advanced laboratory work" along the line of his own research, the laboratory period coming at regular scheduled

hours, and making it obligatory for the teacher to be on hand and to decline other engagements, which might otherwise be given precedence.

Such an arrangement adds zest to the work, in that it creates the atmosphere of mutual understanding and interest so much prized in the graduate school, and clarifies the teacher's own thinking as he explains the details to the students. It may afford, moreover, some little positive assistance, for there may well be parts of the routine experimental work or calculations that students can become skilful enough to perform with entire satisfaction. Several years ago, for example, I had on hand a piece of work in which an important part of the procedure was the repeated performance of very accurate weighings. I trained four students, at various times, in the theory of the balance and the practise of precise weighing, and while I prepared specimens, the students weighed them with as much skill and care as I myself could have done it. By no means the least benefit of this plan is its effect upon the student. No better training in perseverance and accuracy, no greater incentive to advanced study, no clearer insight into the real spirit of research, could be afforded the young learner than by this means. The realization that he is actually contributing to the sum of human knowledge is, to his developing nature, exhiliarating in the extreme. And best of all, no greater opportunity could be offered the teacher for that personal touch and influence which is the sacred privilege of the teacher's profession.

The research worker should make his work known. It is a most helpful thing to crystallize one's ideas from time to time in the form of connected statement, or better still, to keep a continuous written account of his procedure, his difficulties, and his results. To this end, he will find it of advantage to identify himself, by correspondence at least, with some not too distant university seminar, and contribute to its programs at suitable intervals in the form of research reports; to participate actively in the work of scientific organizations such as the Academy of Science, the American Physical Society, etc.; and to prepare his communications in suitable form for printing, at least in abstract. Another helpful feature is found in having a local scientific club, similar to the Baconian Club of this university or the Kelvin Society of Coe College, where people of somewhat kindred interest may get together and exchange experiences and catch something of one another's vision. In these ways the research worker gains the benefit of friendly encouragement and equally friendly criticism, and often has cause to appreciate the maxim that "two heads are better than one."

Above all, let us realize that we are never too old to learn, and that the most dangerous thing a teacher or a scientific man can do is to cease studying. Let the college scientist read books on new phases of his subject as they come out, even if he does not follow every technical detail, and even if he is obliged to borrow them from some university library for the purpose. Let him keep a classified card index of all the periodical literature available on his subject, noting especially articles that may suggest lines of investigation of particular interest to himself. Let him think beyond the daily topics of the classroom, let him mingle with practical men and get the bearing of his science on the affairs of the world. And what is most important, let him keep in touch with others of his calling, through visits and correspondence, so that in every possible way he may be open to the inspiration which comes with the pursuit of truth. For it is in these ways that the man who contributes to the welfare of mankind through scientific research lays his heavy foundations.

LeRoy D. Weld

Coe College,
Cedar Rapids, Iowa,

WAXY MAIZE FROM UPPER BURMA

A variety of maize introduced from Shanghai, China, in 1908, was found to have seeds with a new type of endosperm. In the seeds of this variety the texture of the starchy tissue is unlike that of any variety previously known. This new type of endosperm has been called waxy. Although distinct from other types, waxy endosperm is by no means

conspicuous, and since all the previously known types of endosperm are very widespread, essentially coextensive in fact with maize on the American Continent, it seemed not improbable that the existence of waxy endosperm in America had been overlooked.

With the hope of discovering the origin of this type of endosperm the collection of maize varieties in the Office of Crop Acclimatization was gone over with endosperm texture particularly in mind. The geographical distribution of the varieties examined was as follows: North America, north of Mexico, 369 varieties; Mexico, 152; Central America, 105; West Indies, 9; South America, 378; Europe, 60; Asia, 78; Africa, 22; Islands of the Pacific, 3.

The results of this investigation were entirely negative. The variety imported from Shanghai was the only one in which waxy endosperm was found. Not only was waxy endosperm absent from the American continent, but it appeared to be confined to the one locality in Asia.

In 1915 Mr. H. O. Jacobson was commissioned to make a special study of the distribution of the waxy type of maize in China. He found it at Tanyang near Suchou and at Táitsáng, but in both of these localities it was found to have been introduced from Liuho near Shanghai. Mr. Jacobson's observations are summarized in his report as follows:

1. The distribution of the waxy corn is very limited. When found away from Liuho, the original seed can be traced back to that community. Dr. Farnham states he noted the white waxy variety as Liuho fifty years ago.

2. The reason for limited distribution is that but little corn is grown in the immediate vicinity of Liuho, because it is not as profitable as other crops. Secondly, it is a poor yielder when compared with the varieties grown about Nanking, and, thirdly, it perhaps does not make as good "grits" as the corneous sorts.

3. I can not find any legend whatever. Among the farmers it is known by the usual name applied to maize and at Táitsáng, at least, no difference is made between the waxy and non-waxy.

4. At Táitsáng the non-waxy sort is cultivated, as well, and judging by the percentage of non-waxy seed ears saved, the waxy seed ears are very much in the minority.

No additional examples of this new type of endosperm came to light until late in 1915 when a few waxy seeds were found in a sample of maize collected for the Office of Foreign Seed and Plant Introduction by Mr. F. Kingston Ward in Upper Burma.

Breeding experiments showed the endosperm character from the two localities to be genetically identical. Independent origin seemed very unlikely nor was it probable that seed could have been imported from Shanghai into this remote region of Upper Burma. It was therefore assumed that although the sample contained but few waxy seeds, there must be somewhere in the Burma region, at least one locality where waxy maize was the prevailing type.

This expectation has been fully realized, the demonstration coming in the form of a collection of maize varieties recently received by the Office of Seed and Plant Introduction from Mr. E. Thompstone, Deputy Director of Agriculture, Northern Circle, Burma.

The collection consisted of 46 samples from the Northern and Southern Shan States and the Pokokku Hill Tract, most of the varieties with distinctive native names. Of the 46 samples twelve were found to have a horny endosperm, 19 a waxy endosperm and 8 were mixed. The remaining samples had been completely destroyed by insects.

One of the lots from the Southern Shan States consisted of eleven ears all of a uniform dark blue color and all waxy. Another sample consisted of 8 ears which were uniformly white, blue or pink, all of them having a waxy endosperm.

The discovery of this unique character of a plant of American origin in two isolated localities of Asia makes it of interest to learn something of the agricultural practises of the people growing this type of maize.

An excellent account of the various tribes of Upper Burma is given by Scott.[1]

From this and other official accounts it

[1] Scott, J. G., "Gazetteer of Upper Burma and the Shan States," 5 vols. Rangoon, 1901.

appears that the growing of maize is largely confined to the less civilized tribes living in the more mountainous and inaccessible parts of the country. Thus

> The Tingpan Yoo are an agricultural people, but they cultivate only in the hills and not generally at a lower altitude than from 4,000 feet above sea-level. They grow paddy, cotton, maize and poppy.[2]

Another primitive tribe, the Wa, grow maize and buckwheat as their only crop plants. So isolated is this tribe that Mr. Scott, writing in 1846, makes the statement that

> One British party has passed through the heart of the wild Wa country and they are perhaps the only strangers who have ever done so.

This isolation is due to the natural inaccessibility of the country which is six or seven thousand feet above sea level and exceedingly broken in character and to the dangers to which travelers are exposed from the natives. The Wa are still such ardent head hunters that few outsiders care to enter their country. Yet head-hunting with the Wa seems to be an agricultural rather than war-like practise. It is furthermore subject to certain restrictions as the following quotation shows:

> Though heads are taken in an eclectic, dilettante way whenever chance offers, there is a proper authorized season for the accumulation of them. Legitimate head-cutting opens in March and lasts through April. The old skulls will ensure peace for the village, but at least one new one is wanted, if there is not to be risk of failure of the crops, the opium, the maize and the rice.[3]

In the Sagaing district, which is just south of Mandalay, maize is grown with lima beans, the maize plants serving as supports for the beans. This in one of the regions where the crop is grown for the husks rather than the grain.

> When young the cobs are enveloped in large, soft, leaf-like sheaths. These sheaths, when dried, are known to Burmans as *pet* and are used as wrappers for Burmese cheroots. The production of *pet* is the most important use of the plant. The cobs or female inflorescences are rarely allowed to mature, unless when wanted for seed, but are boiled and eaten as a vegetable.[4]

In *Scott's Gazetteer* the husks, as cheroot wrappers, are repeatedly mentioned as the most important use of maize. It also appears that the native varieties are especially adapted to this purpose, thus it is stated that in Pakokku

> American maize was grown for a time experimentally, but the husks proved too coarse for cheroot covers.[5]

We may therefore assume that the "Whackin white cheroot" of Kipling's Supi yaw lat was wrapped in the husks of waxy maize.

During the past season waxy endosperm has been discovered in still another part of Asia by Dr. W. H. Weston. Four ears grown at Los Baños in the Philippine Islands from seed originally from the Island of Mindanao were sent to the Department of Agriculture by Dr. Weston. All these ears contain a small percentage of waxy seeds.

At present there is no way of deciding whether this occurrence of waxy endosperm in the Philippines is the result of a recent introduction from Shanghai or whether it represents another of the early stations comparable with Burma and Shanghai.

Waxy endosperm has been used extensively in genetic experiments and has been crossed with all other known types of endosperm. It continues to behave as a single Mendelian unit inherited in a strictly alternative manner. It is in fact the only character of maize studied at all exhaustively, for which no modifying factors have been found.

The strictly alternative inheritance of waxy endosperm would suggest that it had originated through a single mutation. Parallel mutations are not uncommon but it is difficult to believe that the same mutation should have occurred independently in two localities

[2] *L. c.*, vol. I., Pt. I., p. 602.

[3] Scott, J. G., "The Wild Wa," *The Imperial Asiatic Quarterly Review*, 1896, p. 143.

[4] McKerral, A., Agricultural Surveys No. 2, Dept. of Agri., Burma, p. 10. 1911.

[5] *L. c.*, Pt. II., Vol. II., p. 723.

in Asia where maize is but little grown and should not have come to light on the American Continent where maize is cultivated so extensively and the varieties are so much better known.

If it is admitted that the waxy character is the result of a single mutation then all discussion of the time when it arose is of course idle, for a single mutation may have occurred as well at one time as another. There still remains the peculiar distribution of waxy endosperm and the differentation of other characters as evidence of the antiquity of the waxy mutation. The Shanghai variety in which waxy endosperm was first discovered possessed other peculiarities, the most conspicuous of these being erect leaf blades, monostichous arrangement of the upper leaf blades and an early development of silks while the ear is still enclosed in the leaf sheath. Unlike waxy endosperm, these characters are not definitely alternative in inheritence, but appear in varying degrees in crosses with varieties not showing these characteristics.

Although the expression of all these plant characters is variable even in the uncrossed waxy strain, pure stocks of this variety always present a distinctive appearance that immediately separates them from any other variety. It has been demonstrated that none of these plant characters is correlated with endosperm texture nor are any of them correlated with one another. It is, therefore, not surprising that the plants grown from the waxy seeds from Upper Burma did not resemble the Shanghai variety in any other particular. If the view that the waxy maize of Shanghai came originally from the region of the eastern Himalayas be accepted, we must conclude that sufficient time has elapsed since the introduction for the Shanghai variety to acquire its distinctive characters.

In the light of our present knowledge this unique character of an American plant appears to be confined to three isolated localities in Asia. Unfortunately, nothing is known regarding the maize varieties of Yunnan or other points along the route from Burma to Shanghai. If the waxy character originated in only one of these localities, however, it would seem much more reasonable to assume Burma as the region from which Shanghai received the character than vice versa. This is indicated by the inaccessibility of the region occupied by the Hill Tribes of Burma, the specialized uses of the plant, and the extensive series of named varieties.

The finding of this peculiar type of endosperm in the mountain region of Upper Burma supports the idea that maize entered China from the west instead of the east. This is in accord with the early Chinese accounts of maize as presented by Dr. Laufer. A more thorough knowledge of the maize varieties of the Himalayan regions promises to be the key to the distribution of maize in Asia.

G. N. COLLINS

BUREAU OF PLANT INDUSTRY,
DEPARTMENT OF AGRICULTURE

PHYSICAL MEASUREMENTS IN PSYCHOLOGY

THE recent article by Dr. Paul E. Klopsteg[1] on physical methods and measurements and the obligation of physics to other sciences, carries a strong appeal for those psychologists who are obliged to prepare students for research in the investigations of human behavior. The specialization found in the psychological laboratories is often merely due to the development of a special technique in physical measurements suited to a whole series of problems, rather than to a restricted psychological interest. Recent progress in psychological methods demonstrates very clearly that every problem dealing with the fundamental aspects of human behavior is also partly a physical problem. Much of the apparatus used in making measurements is "home-made" and while good results have been secured, it is equally true that better experimental results would be secured and much time saved if some expert in physical measurements, who is also interested in the

[1] SCIENCE, April 16, 1920, N. S., 51, 384–386.

application of objective methods to research work in psychology, were available when the apparatus is designed.

Under the present methods of preparing for a research problem requiring apparatus, the student in psychology begins to look through the literature to find how the phenomena that he expects to investigate were measured by other investigators. The original method of measurement may have been merely an accident of time, place and the available equipment. If the student is not mechanically expert, imitation is the only alternative. By the trial and error method, improvements do gradually develop but at a great loss of time and at the expense of accuracy and reliability.

While as a rule the men in physics show a fine cooperative spirit, students do not feel free to take up the time of a professor when such cooperation is not a regular part of the instructor's duties. The writer is not in sympathy with the view that better preparation in applied physical measurements should be given in the elementary course. Even the relatively extended course in "engineering physics" is little enough physics for the student in psychology. The problem of adequate training in physical measurements seems, to the writer, to belong to the graduate school, and should be as integral a part of the preparation of the science student as his preparation in foreign languages. The graduate faculty should support the department of physics in developing a course in applied physical measurements whose prime function is not that of teaching physical principles but that of preparing students to take advantage of the latest technical developments in physics. The more comprehensive the student's knowledge of the fundamental principles of physics, the better, but it must be recognized that the adjustment between physical principles and the principles of the other sciences, is always a compromise.

Perhaps one reason why courses in applied physical measurements have not been developed, although every scientist will admit their value, is because the graduate students of any one department do not form a large enough group to justify the expenditure of the necessary amount of money for the extensive equipment necessary to adequately carry on such a course. If, however, all the graduate students in the biological and physical sciences were gathered together under the direction of a high-class instructor, the time devoted to applied physical measurements would actually result in a saving of time and secure better cooperation from the department of physics than is usually accorded. Such a course should be in the hands of an instructor who is willing to keep abreast of what is going on in the other sciences. Such a man should be especially well grounded in general scientific theory so he can understand the problems of the other sciences. Developmental work in the applications of physical measurements to the other sciences should offer as good research opportunities as "pure" physics for the man whose interests are in the applied field. It is a mistake to assume that an expert machinist is the man wanted.

It must be recognized that the students taking applied physical measurements will probably not contribute directly to the advancement of physics. This implicitly may develop the attitude on the part of the professor in charge that these students are mercenaries who are commercializing physics. If this attitude is general in the department of physics, it is easy to see why no particular attempt is made to get the equipment and the type of instructor necessary to teach this work as satisfactorily as in the courses intended for students specializing in physics. It is the same attitude that is so often found in the instructors who are obliged to teach "scientific" German or French.

For students specializing in experimental psychology it is coming to be recognized more and more that in the work for the doctorate, training in the allied sciences and methods of physical measurements is quite as important as training in psychology. There is no danger that the student will neglect his psychology, but he may neglect important pre-

paratory courses unless they are taken before the doctorate is completed. Every psychologist recognizes his own limitations in applied physical measurements and a course as outlined by Dr. Klopsteg would do much toward extending the limits for the younger men.

In the writer's opinion the best time for taking such a course is before the student has begun experimental work on the problem which is to be the basis for his dissertation. At this time the question of method is uppermost and the problem has already been outlined. If the student is working on apparatus this is the time that the advice of the professor of applied physical measurements is of greatest benefit. These conditions arise in the first year of graduate work, or in a few cases, during the senior year. The course itself, however, should be under the supervision of the graduate school.

Of the seventeen types of physical measurements suggested by Dr. Klopsteg[2] the following would form an excellent background for the experimental psychologist: (1) The accurate measurement of long and short time intervals. (2) Measurement of temperatures by methods other than that of the mercury thermometer. (3) Temperature regulation and control. (4) Precision calorimetry. (5) The microscope and reading telescope. (6) Spectroscopic analysis. (7) Colorimetry and photometry. (8) The galvanometer. (9) Electrical measurements, both alternating and direct. (10) Graphic and smoke records.

With a practical knowledge of the use of these methods the student is qualified to undertake almost any problem in experimental psychology with the assurance that he is using the most approved methods of measuring his conditions and results.

A. P. WEISS

OHIO STATE UNIVERSITY

GENERAL WILLIAM C. GORGAS

WILLIAM CRAWFORD GORGAS, Surgeon General, U. S. Army, during the four years of the European War, 1914–18, and well-known for his work as chief sanitary officer of the Panama Canal, died in London on the early morning of July 4, in the sixty-sixth year of his age. He had sustained a stroke of apoplexy on May 29, lingering for more than a month in hospital with some hope of recovery, but renal complications intervened and he passed away in unconsciousness.

General Gorgas was born at Mobile, Alabama, on October 3, 1854. He was the son of General Josiah Gorgas, Chief of Ordnance of the Confederate Army, and received his earlier education in the South, graduating from the University of the South in 1875. He then went to New York to study medicine, and received his medical degree from Bellevue Hospital Medical College in 1879. He was intern at Bellevue Hospital during 1878–80, and in the last year of his residence in hospital, took an examination for admission to the Medical Corps of the U. S. Army, receiving his commission as surgeon on June 16, 1880. He was promoted captain in 1885 and during the Spanish-American War, served as a major and brigade surgeon of volunteers, receiving his majority in the Regular Army on July 6, 1898. At the close of the Spanish-American War, he was appointed Chief Sanitary Officer of Havana, holding this position from 1896 until 1902. In connection with this important detail, it fell to his lot to apply to the sanitation of Havana the discovery of the late Major Walter Reed, that yellow fever is transmitted by mosquitoes, which was accomplished by Reed, as the head of an Army Board sent to Cuba to investigate yellow fever in 1900–1901. In February, 1901, shortly after Reed's discovery was established, Gorgas began to screen yellow fever patients and to destroy fever-bearing mosquitoes by oiling the surface of all pools or collections of water where they were likely to breed. In three months time, Havana was freed from yellow fever for the first time in nearly two centuries. For this work in eliminating the disease from Havana, Gorgas was made a colonel and assistant surgeon general by special act of Congress on March 9, 1903. On March 1, 1904, he was appointed chief sanitary officer

[2] SCIENCE, April 29, 1919, N. S., 50, 199–202.

of the Panama Canal, where he carried out the same line of work in the cleaning up the Isthmus. When the French, under de Lesseps, began to work on the Panama Canal in 1880, the Isthmus was one of the plague-spots of the world and during their nine years of occupation, they lost 22,189 laborers from disease. When the United States government took charge of the Canal in 1904, the death rate was high and a yellow fever epidemic was going on. In less than a year yellow fever was wiped out and there has not been a single case since May, 1906. Gorgas was made a member of the Isthmian Canal Commission in 1907, and remained in charge of sanitation until the winter of 1913, when he went to South Africa, at the invitation of the Chamber of Mines of Johannesburg, to investigate the high death rate from pneumonia among the natives working in the mines of the Rand. By applying the army methods of increasing the air space of sleeping quarters the death rate was materially lowered. He was appointed surgeon general of the U. S. Army on January 16, 1914, and was given the rank of major general in 1915. In 1916, he spent several month in South America in making a preliminary survey of localities still infested with yellow fever the "endemic foci" of the disease, for the Rockefeller Foundation. Upon his retirement from active duty in the Army in the fall of 1918, he resumed this work and had just started upon an investigation of the African foci at the time of his death. If completed, this work may result in the eradication of yellow fever from the globe. General Gorgas conducted the administration of the Surgeon General's Office in Washington during the war period, and shortly before his retirement, accompanied the secretary of war to France. He was a member of many medical societies and received many honors during his life. He was awarded gold medals by the Liverpool School of Tropical Medicine in 1907, by the American Museum of Safety in 1914, and shortly before his death was decorated by King Albert of Belgium and knighted by King George IV. In March, 1914, he received the degree of doctor of science from the University of Oxford. General Gorgas was a man of attractive character, and highly popular with the medical profession. In 1885, he married Miss Marie C. Doughty, of Cincinnati, Ohio, who survives him with a daughter. He was the author of many articles on the subject of yellow fever.

M. W. Ireland,
Surgeon General, U. S. Army

SCIENTIFIC EVENTS

THE ANNUAL REPORT OF THE REGISTRAR GENERAL OF ENGLAND AND WALES

The eighty-first annual report of the Registrar General which deals with the births, deaths and marriages in England and Wales for the year 1918, has been issued.

According to an abstract in the London *Times* the report shows that the marriage rate was 15.3 per 1,000, being 1.5 above the low rate in the preceding year (13.8), and 0.1 below the average in the last 10 years, 1905–1914, which were unaffected by war conditions (15.4). The provisional figures for 1919 indicate a further rise to 19.7 per 1,000, the highest rate on record.

The birth-rate in 1918 was 17.7 per 1,000, being the lowest on record. This rate was 0.1 per 1,000 below that recorded for 1917, and 6.1 below that for 1914, which, particularly so far as the birth-rate was concerned, might be regarded as the last year unaffected by war conditions. Even this large reduction, however, amounting in all to nearly 26 per cent. in 1918 as compared with 1914, was believed to compare very favorably with the experience of other belligerent countries. The provisional figures for 1919 indicate a recovery, showing an increase of 0.8 per 1,000.

The civilian death-rate in 1918 was 17.6 per 1,000, being 3.2 above the rate in the preceding year. The increased mortality was due to the epidemic of influenza. Apart from this, the year was one of extraordinary healthiness. The provisional figures for 1919 indicate a fall of about 3.8 per 1,000, notwithstanding the continuance of the epidemic into the early part of the year.

Infantile mortality was 97 per thousand

births, being one per thousand above the rate in the preceding year, but 10 per thousand below the average of the 10 years 1908–17. It is one of the four lowest rates hitherto recorded. The provisional figures for 1919 show a rate of 89 per thousand births, or two per thousand births below that of 1916, which at 91 per thousand was the lowest hitherto returned.

The estimate of the total civilian population for the whole of England and Wales is given as 13,777,100 civilian males and 19,697,600 females, making a total of 33,474,700 persons. The marriages during the year numbered 287,-163, and the marriage rates of 51.9 for males and 41.0 for females represented a considerable advance on the low records of the previous year.

The births registered during 1918 numbered 662,661, or 5,685 fewer than in the previous year, during which 210,750 fewer births had been registered than in 1914, while the deaths of 611,861 were registered during the same period. Of the deaths, 314,704 were of males and 297,157 of females. The males included 24,033 non-civilians.

THE WORLD'S PRODUCTION OF GOLD

THE Geological Survey has given out some preliminary figures showing the promotion of gold throughout the world in 1919. The production in the United States was $58,285,196; Canada is reported to have produced $14,-687,000; India $10,028,000; Australia (not including New Zealand or the Islands), $29,-268,000; the Transvaal, $171,640,123; Rhodesia and West Africa, $18,631,070. There was a probably large decrease in the production of gold in Russia and Siberia in 1919. Some increase was probably made in the output of Central America and South America, which however, was doubtless offset by decreases in the output of other countries. The incomplete returns now available indicate that the world's production of gold in 1919 was between $345,000,000 and $350,000,000. The world's production in 1918 amounted to $380,-924,500.

The survey further states that information received during the first six months of 1920 indicated a still further decrease in the production of gold in the United States and that the output for the year will probably be less than $50,000,000. The production in Alaska, Colorado, California, Oregon and Montana will be much less in 1920 than it was in 1919, because water is very short for placer mining and many stamp mills are closed. Canada as a whole may increase its output, although the production of the Yukon districts will be smaller than last year. The output of Russia can not be estimated. That of Australia will show a decrease. That of South Africa and South America will probably show no radical decrease. According to the survey the indications are that the decrease in the world's production of gold in 1920 will not be so great as it was in 1919.

PROFESSOR VAN BENEDEN OF LIÉGE

A LIFE-SIZED bronze statue of Van Beneden, professor of zoology in the University of Liége, who died four years ago, was unveiled on May 24. The statue stands at the entrance to the Zoological Institute where Van Beneden worked and taught for over thirty years. We learn from the *British Medical Journal* that the ceremony was attended by a large number of his old colleagues, by representatives of other Belgian universities and scientific societies, and by delegates from British universities. Both King Albert and the Belgian Parliament were represented. The representatives of the British universities were Professor Sarolea (Edinburgh), Sir Leslie Mackenzie, of the Local Government Board of Scotland (Aberdeen), and Professor Sir Thomas Oliver (Durham). Professor R. W. Hegner, represented the Johns Hopkins University, Baltimore. When fully mustered the company marched in procession to the class-room where Van Beneden had taught and in which was gathered a large number of old and present students and his widow and relatives. The Rector was in the chair. Dr. Nolf, professor of pathology in the university, delivered a memorial address, during which a beautifully executed bronze mural tablet, pronounced to

be an excellent likeness, was unveiled. Professor Gravis (botany), M. Lameere (president of the Belgian Royal Academy of Science), Professor Van der Stricht (Ghent), Professor Sarolea (Edinburgh), and Professor Ditmas, successor to the late professor, delivered addresses containing references to the epoch-making researches of the great embryologist and his work upon fecundation and cell reproduction. The speaker who drew the greatest applause was Van der Stricht, who, while pleading for the University of Ghent, insisted upon it retaining its French character as opposed to a purely Flemish institution. When he had finished his address the Rector, rising amidst the applause of the audience, kissed the distinguished Fleming upon both cheeks. Afterwards the audience proceeded to the front entrance, where the full-sized statue in bronze was unveiled. A luncheon, attended by several of the delegates and the rector of the university, followed.

THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH

The board of scientific directors of the Rockefeller Institute for Medical Research announces the election of Dr. Winthrop J. V. Osterhout as a member of the board of scientific directors to succeed Dr. Theodore C. Janeway, deceased.

The following promotions and appointments are announced:

Dr. Alfred E. Cohn, hitherto an associate member in medicine, has been made a member.

Dr. Peyton Rous, hitherto an associate member in pathology and bacteriology, has been made a member.

Dr. Donald D. Van Slyke, hitherto an associate member in chemistry, has been made a member.

Dr. Francis G. Blake, hitherto an associate in medicine, has been made an associate member.

Dr. John H. Northrop, hitherto an associate in experimental biology, has been made an associate member.

Dr. James H. Austin, hitherto an assistant in medicine, has been made an associate.

Dr. Harry W. Graybill, hitherto an assistant in the department of animal pathology, has been made an associate.

Dr. William C. Stadie, hitherto an assistant in medicine, has been made an associate.

The following have been made assistants:

Miss Helen L. Fales (chemistry).

Dr. Philip D. McMaster (pathology and bacteriology).

Miss Marion L. Orcutt (animal pathology).

The following appointments are announced:

Dr. Harry Clark, associate member in pathology and bacteriology.

Dr. Pierre L. du Nouy, associate member in experimental surgery.

Dr. Paul H. de Kruif, associate in pathology and bacteriology.

Dr. Lloyd D. Felton, associate in pathology and bacteriology.

Dr. Rudolf W. Glaser, associate in the department of animal pathology.

Dr. Carl A. L. Binger, assistant in medicine.

Dr. Ralph H. Boots, assistant in medicine.

Dr. Louis A. Mikeska, assistant in chemistry.

Dr. Charles P. Miller, Jr., assistant in medicine.

Dr. Eugene V. Powell, assistant in X-ray.

Dr. Leslie T. Webster, assistant in pathology and bacteriology.

Dr. Goronwy O. Broun, fellow in pathology and bacteriology.

Miss Katharine M. Dougherty, fellow in pathology and bacteriology.

Mr. Thomas J. Le Blanc, fellow in pathology and bacteriology.

Dr. Giovanni Martinaglia, fellow in the department of animal pathology.

Mr. Henry S. Simms, fellow in chemistry.

Dr. Marshall A. Barber, hitherto an associate in pathology and bacteriology, has accepted a position with the U. S. Public Health Service to do field work in the Malaria Research Laboratory, Memphis, Tennessee.

Miss Angelia M. Courtney, hitherto an associate in chemistry, has accepted an appointment to do chemical work in the Medical School of the University of Toronto.

Dr. Carl Ten Broeck, hitherto an associate in the Department of Animal Pathology, has accepted an appointment as associate professor of bacteriology with the Peking Union Medical College.

Mr. Earl P. Clark, hitherto an assistant in

chemistry, has accepted a position with the Bureau of Standards, Washington, D. C.

Dr. Ferdinand H. Haessler, hitherto an assistant in pathology and bacteriology, has accepted an appointment as resident pathologist in the Department for Nervous and Mental Diseases in the Pennsylvania Hospital at Philadelphia.

Dr. Arthur B. Lyon, hitherto an assistant in medicine, has resigned to enter private practise.

SCIENTIFIC NOTES AND NEWS

THE University of Wisconsin has conferred the degree of doctor of laws on Dr. Alonzo E. Taylor, professor of physiological chemistry, at the University of Pennsylvania, and the degree of doctor of science on Dr. Joel Stebbins, professor of astronomy at the University of Illinois.

THE degree of doctor of science was conferred on Dr. C. C. Adams, director of the Roosevelt Wild Life Forest Experiment Station at the college of forestry of Syracuse University by Illinois Wesleyan University, on the twenty-fifth anniversary of its founding.

PROFESSOR JOHN W. TOWNEY, dean of the Yale Forest School received the degree of LL.D., at the commencement exercises of the New York State College of Forestry at Syracuse University.

THE University of Vermont has conferred the degree of LL.D., on Dr. Edward G. Spaulding, professor of philosophy in Princeton University.

THE University of St. Andrews has conferred the degree of LL.D., on Dr. Leon Fredericq, for nearly forty years professor of pathology in the University of Liége, Belgium; on Mr. W. J. Matheson, president of the biological laboratory of the Brooklyn Institute, and scientific adviser in chemistry to the Board of Health for the city of New York, and on Dr. Norman Walker, inspector of anatomy for Scotland and direct representative of the profession in Scotland on the General Medical Council, and on Dr. Norman Kemp, Smith professor of logic and metaphysics at the University of Edinburgh.

THE Association of American Physicians has elected as honorary members: Sir Clifford Allbutt, University of Cambridge, M. Roux, until recently director of the Pasteur Institute, Paris, Professor Heger of Brussels, and Professor Marchiafava of Rome.

AT the meeting of the Linnean Society on May 27 the gold medal of the society was handed by the president to Sir Ray Lankester, to whom it had been awarded by the president and council.

DR. J. G. ADAMI, vice-chancellor of the University of Liverpool, and lately Strathcona professor of pathology and bacteriology in McGill University, has been elected to an honorary fellowship at Christ's College, Cambridge, of which he was formerly a scholar.

DR. E. F. LADD, president of the North Dakota Agricultural College, and previously professor of chemistry, has been nominated by the Republican party for the senate in place of Senator Gronna. Dr. Ladd was the candidate of the Non-Partisan League.

DR. HENRY KRAEMER, dean of the school of pharmacy of the University of Michigan, has resigned. He will continue his investigations on the cultivation of medicinal plants and the nature and distribution of color in plants.

DR. E. F. NORTHRUP has resigned from Princeton University as assistant professor of physics, having been elected vice-president and technical adviser of the recently organized Ajax Electrothermic Corporation, of Trenton, N. J., which manufacturers the high frequency induction furnace which he developed in the Palmer Physical Laboratory.

DR. E. W. GUDGER, after fourteen years service as professor of biology in the North Carolina College for Women, Greensboro, N. C., has resigned. During the coming year he will be at the American Museum of Natural History, associated with Dr. Bashford Dean as editor of Volume III. of the Bibliography of Fishes, Volumes I. and II. of which have already appeared.

T. Nelson Dale, geologist of the United States Geological Survey and author of bulletins on the Economic Geology of Slate, Granite and Marble, owing to the "Retirement Act," will, on August 21, 1920, take up the work of a consulting geologist in problems pertaining to slate, granite, marble, lime-rocks and the drilling for water.

Dr. Walter A. Ver Wiebe, formerly connected with the geological faculties of Cornell University and the Ohio State University, and more recently field geologist for the Roxana Petroleum Company of Tulsa, has been chief geologist for the Mexican Sinclair Petroleum Corporation since April of this year, with headquarters in Tampico.

Dr. T. S. Taylor, who has, during the first part of the present calendar year, been in charge of the research work for the Magnesia Association of America at the Mellon Institute of Industrial Research, University of Pittsburgh, Pittsburgh, Pa., returned on July 1 to the Research Laboratory of the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., to take charge of their thermal research.

Mr. Earl Stafford has become a member of the engineering staff of Arthur D. Little, Incorporated, chemists and engineers, Cambridge, Mass. Mr. Stafford is a graduate of the engineering school of Tufts College, 1908, and for the past twelve years has devoted his attention largely to hydro-electric developments with particular reference to ore treating plants, pulp and paper mills and light and power companies.

Dr. George H. Parker, professor of zoology, has been appointed Harvard exchange professor for next year to the western colleges.

The commencement address at the University of South Dakota, on June 21, was given by Dr. George F. Swain, of Harvard University, the subject being "The Dangers of Idealism."

The Halley lecture at Oxford is to be delivered this year by Professor R. A. Sampson, astronomer royal for Scotland.

In memory of the late Major-General William C. Gorgas, funeral services under the auspices of the British government were held in St. Paul's Cathedral on July 9. Troops escorted the body to the cathedral and a military salute was fired at Hyde Park as the procession filed along the street from Queen Alexandra's Military Hospital to St. Paul's. Pall bearers included presidents of the Royal College of Physicians and the Royal College of Surgeons, and the director of the British Army Medical Service.

Dr. E. Mead Wilcox, director of the Agricultural Experiment Station and College of Agriculture in Santo Domingo, is in the United States for the purpose of securing additional men for his staff and the selection of laboratory equipment. He desires to secure a horticulturist, plant pathologist, chemist, veterinarian, and animal husbandryman and will be glad to enter into correspondence with persons interested. In addition to special knowledge of the particular subject some knowledge of Latin, French or Spanish is essential. Correspondence should be directed to him in care of Arthur H. Thomas Company, Philadelphia, Pa.

Mr. John D. Rockfellee, Jr., has given the new management of the New York State Reformatory for Women in Bedford the use of the social hygiene bureau and laboratory situated alongside the institution, for the study and scientific treatment of prisoners. The laboratory was built and equipped at a cost of $200,000. Mr. John S. Kennedy, president of the State Prison Commission, recently urged that the laboratory be taken over. It was closed four years ago when Miss Helen A. Cobb, recently resigned, became superintendent of Bedford Reformatory. Miss Florence Jones, the new superintendent, and Dr. Phyllis Blanchard, who has been appointed psychiatrist, were in conference in relation to the psychiatric work. Mr. Rockefeller has consented to let the new administration use the laboratory at a rental reported to be $1 a year.

The program of the eighth annual meeting of the Eugenics Research Association, held at

Cold Spring Harbor, on June 25, was as follows: President Stewart Paton's address: "Democracy's opportunity." R. H. Johnson: "Some eugenical aspects of the distribution of wealth." Madison Grant: "The present racial outlook in the world at large." A. H. Estabrook: "The eugenical bearing of psychological work of the army." A. J. Rosanoff: "Preliminary report of a study of the prevalence of chronic psychoses in the population of the State of New York." Anna M. Peterson: "The eugenical aspect of custodial institutions for women." F. Stuart Chapin: "The scientific aspects of field work in the social sciences." C. B. Davenport: "Heredity of twins." H. H. Laughlin: "The eugenical provision of the constitution of the German republic."

FREE public lectures are being delivered in the lecture hall of the Museum Building of the New York Botanical Garden, Bronx Park, on Saturday afternoons, at four o'clock, as follows:

July 17. "Spoilage of fruits and vegetables during transportation and storage," F. C. Meier.

July 24. "The state park at Devil's Lake, Wisconsin," Dr. A. B. Stout.

July 31. "Flowers for the summer garden," G. V. Nash.

August 7. "Diatoms—plants of beauty seen through a microscope," Dr. M. A. Howe.

August 14. "Through the Philippines with a kodak," Dr. H. A. Gleason.

August 21. "How to know, gather and cook the puffballs," Dr. W. A. Murrill.

August 28. "A trip to Colorado," Dr. F. J. Seaver.

In order to provide a method for viewing the collections of the garden under guidance, a docent leaves the front door of the museum building every week-day afternoon at 3 o'clock, to escort all who may wish to accompany him. The routes are as follows: Monday: Hemlock Forest, Mansion and Herbaceous Garden. Tuesday: Pinetum. Wednesday: Fruticetum and North Meadows. Thursday: Deciduous Arboretum, Public Conservatory Range 2, Nurseries, and Propagating Houses. Friday: Public Conservatory Range 1. Saturday: Museums.

UNIVERSITY AND EDUCATIONAL NEWS

DR. RODNEY HOWARD TRUE, of the U. S. Department of Agriculture, has been appointed professor of botany in the University of Pennsylvania, to succeed Dr. John M. Macfarlane, who recently resigned.

DR. WALTER TAGGART has been appointed Blanchard professor of chemistry and director of the chemical laboratory of the University of Pennsylvania, to succeed Dr. Edgar F. Smith.

DR. H. R. KRAYBILL, of the Bureau of Plant Industry, has been appointed professor of agricultural chemistry and head of the department of chemistry of New Hampshire State College.

ADDITIONAL appointments in Colorado College for 1920–21 include, as assistant professor of geology, Mr. I. A. Keyte, B.S. (Missouri), recently head of science work in the Colorado Springs High School, and, as instructor in physics, Mr. Elmer Furnquist, A.M., (Illinois), recently an instructor in that institution.

REINHOLD F. A. HOERNLE, assistant professor of philosophy at Harvard University, has resigned in order to accept a professorship at Durham University.

DR. W. J. DAKIN, professor of biology in the the University of Western Australia, has been appointed to the Derby chair of zoology, University of Liverpool, in succession to the late Professor Leonard Doncaster. Dr. I. M. Heilbron, professor or organic chemistry at the Royal Technical College, has been appointed to the chair of organic chemistry.

DR. BENJAMIN MOORE, of the research staff at Oxford, has been appointed to the new chair of biochemistry.

DISCUSSION AND CORRESPONDENCE

INTERSEXES IN DROSOPHILA AND DIFFERENT TYPES OF INTERSEXUALITY

TO THE EDITOR OF SCIENCE: In your issue of March 26, 1920, there appeared an important article by Dr. Sturtevant, in which he proved that intersexuality may be produced in

Drosophila simulans by the action of a mutant gene. He concludes with the remark:

> It has been assumed by Goldschmidt, Hertwig, Banta, and others working with intersexes that in their animals the normal sex-determining mechanism itself was failing to function as usual. The present example shows that such an assumption can not be accepted without proof.[1]

May I be allowed to point out some very important distinctions between this present example and the best worked-out of the others, namely Goldschmidt's intersexual moths (*Lymantria*). (1) Sturtevant's intersexual *Drosophila* are all females. Goldschmidt has obtained intersexes in both sexes. (2) The gonads in Sturtevant's example are described as "minute, if present." In *Lymantria,* instead of such marked reduction occurring, the gonad is transformed, partly or wholly, into that typical of the other sex. (3) Most important of all, Sturtevant's flies appear to be all of one type or grade of intersexuality. Goldschmidt's moth intersexes, both male and female, form a continuous series from normality to complete sex-reversal. (4) Goldschmidt's analysis of his material has shown that the *Lymantria* intersexes are zygotes which have started development as individuals of one sex, but at a given point have been switched over to continue as individuals of the other sex. The degree of intersexuality depends on the point of time in development at which the change occurs. It is essential to have an analysis of the *Drosophila* case from this point of vew, before further comparison is profitable. (5) When a highly intersexual female *Lymantria* which is functional as a male is mated with a normal female, the sex-ratio in the resulting broods is what would be expected if both parents were of Z W chromosome constitution; the same is true when, instead of high-grade intersexes, such individuals of all male broods as must be supposed to be transformed females are bred from.

With these differences between the intersexuality of *Drosophila* and that of *Lymantria,* we can not be sure that the two are quite comparable, or due to the same set of causes. In conclusion, it may be said that the Columbia School itself has made it exceedingly probable that the function of the sex genes is normally to initiate one series when present in two doses; the one series of reactions allowing of the appearance of the structures and instincts of one sex, the other of those of the other sex. If this is so, then there is theoretically nothing whatever against the possibility of these series of reactions, and the physiological states to which they give rise being altered, (1) by the mutation of independent genes (as appears undoubtedly to be the case in *D. simulans*); (II) by an alteration in the balance between the sex-genes and other factors influencing development, (as would seem more than probable in *Lymantria*); or, (III) by external agencies (as apparently in Hertwig's and Kuschakewitsch's experiments on frogs and Miss King's on toads). The burden of proof, in the present state of our knowledge, lies even more on the upholders of gene-produced intersexuality than on the upholders of the balance theory, but quite possibly both are right.

Julian S. Huxley

New College, Oxford,
May 1, 1920

[1] To this list should be added Harrison, *Jour. Genetics,* 9, 1919, p. 1.

THE ORIGIN OF OIL

A. W. McCoy has published in *Journ. Geol.* XXVII. (1919), pp. 252–262, evidence that crushing oil shale converts some of the solid organic matter into oil. The conditions of the experiment seem to preclude any chance for much general heating of the mass of shale used.

Can some mathematical physicist tell us whether a strain or shear would cause a high temporary temperature at the point of rupture? The heat would be absorbed by the adjacent rock and would not greatly increase the temperature of the whole mass, unless the quantity of heat were large. Yet the temperature at some points *might be* high enough for a very short time to cause the dissociation of the organic molecules adjacent

to these points. The effect probably would be concentrated on the surfaces of maximum strain and shear.

The results of this enquiry may be of fundamental significance in theories of the origin of oil. The writer will appreciate any information thereon.

CHESTER W. WASHBURNE

60 LIBERTY STREET,
NEW YORK CITY

THE CAUSES AND PREVENTION OF AFTER CORROSION ON THE BORES OF FIREARMS[1]

THE report of an experimental study, containing also a careful review of the scientific, patent, and trade literature and a compilation of empirical experiences which have variously attributed after-corrosion on oiled bores as due to powder acids, diffusing gases, primer acids, metal fouling, and chlorides.

Humidity relations, chemical examination of the corrosive residue, special ammunition, and a study of many so-called "gun oils" and "nitrosolvents" showed:

The infantry service cartridge leaves no nitrocellulose or acid residue. The after-corrosion is caused by (1) the deposition of a water soluble salt or salts capable of giving corrosive solutions, (2) the presence of a humidity high enough to form a liquid film, and (3) the presence of oxygen. In the service ammunition, the decomposition of the chlorate of the primer furnishes the only water soluble salt. Pits and tool wounds retain this, so that it can not be removed mechanically. It may be dissolved by water. Corrosion may also be prevented by stoppering the bore or by altering the composition of the primer. A number of the non-aqueous compositions sometimes recommended for cleaning rifles are of no value. Their virtues apparently rest on tests conducted at humidities so low that no corrosion could occur.

The paper is illustrated with photographs and photomicrographs. It presents a simple test for differentiating between worthless and useful "nitrosolvents" and also discusses the corrosive effects of black powder and low pressure nitrocellulose powders.

WILBERT J. HUFF[2]

BUREAU OF MINES,
WASHINGTON, D. C.

[1] Published by permission of the director of the U. S. Bureau of Mines.

SCIENTIFIC BOOKS

An Introduction to Entomology. By JOHN HENRY COMSTOCK, Professor of Entomology and General Invertebrate Zoology, Emeritus, in Cornell University. Ithaca, N. Y., Comstock Publishing Company. 1920, xviii + 220 pages, 220 figs.

The dean of American entomologists has just issued the first part of a second edition, entirely rewritten, of his long-known text-book called "An Introduction to Entomology." It covers the structure and metamorphosis of insects, and it covers these subjects in such complete and thoroughgoing way and, at the same time, in such compact manner, as to make the book by all odds the very best of extant texts to put into the hands of entomological and zoological students. It will be indispensable for beginning students; it will be very useful for advanced ones.

Such large compendiums as Berlese's (as yet only available in the original Italian), and Sharp's (in the English "Cambridge Natural History") and Packard's "Text-book of Entomology," are all of a character which limits their use in the laboratory to that of reference books; they are too extended and expensive, to say nothing of their less adapted organization and general make-up, to permit their use as actual individual laboratory handbooks. Comstock's book fills exactly the long-felt need. It contains all the knowledge up to the very present, carefully analyzed, sifted, and a great part of it actually contributed or tested by Comstock and his students, that the general student of insect structure and post-embryonic development needs to know. And it is all packed away, in perfect arrangement, with elaborate analytical contents, sufficient index and bibliography and carefully chosen illustrations, in about two

[2] Chemist, Pittsburgh Experiment Station, Bureau of Mines.

hundred pages, clearly printed on good paper, and substantially bound in convenient format. The experience of a veteran text-book maker and user shows in every feature of this book's construction.

The new book is "affectionately inscribed" to the author's "old students whose youthful enthusiasm was a constant inspiration" during a long period of service as teacher, as an effort to further aid them, though they are now gone from his classrooms and laboratories. Professor Comstock may rest assured that his greeting will be quite as affectionately returned, and that his latest effort will be as gratefully received by his many scattered students, mostly now no longer youthful, as were his earlier efforts to instil in them that love of nature and passionate interest in learning to know nature's works which have been for so many years beautifully characteristic of their beloved mentor. These old students will be greatly helped by this effort in their attempts to carry on to new students the Comstock tradition. And American entomology has not had, nor will ever have, any finer tradition.

Vernon Kellogg

SPECIAL ARTICLES

"PHYSICAL CONSTANTS" PERTAINING TO THE OCEAN

An important object of the science of physics is description of the behavior of different substances. Expression in mathematical form of such descriptions requires the use of one or more "physical constants," such as the coefficient of elasticity, conductivity, etc. Constants thus obtained are generally regarded as intrinsic, or peculiar to the substance. The extensive list of "physical constants" already determined bears witness to the achievements of physics, and constitutes fundamental quantitative data of the science.

Application of the methods of physics to terrestrial phenomena taking place on a correspondingly immense scale, has likewise resulted in physical laws or descriptions capable of expression in mathematical form. But the corresponding "physical constants" can not be evaluated by means of experiments necessarily limited to much smaller dimensions. The influence of the enormous magnitudes involved in many terrestrial phenomena can be determined only by observing the phenomena as they take place in nature. It is impossible, for example, to determine in detail the motion of the water particles in the convective circulation of even a limited part of the sea. But this would be necessary in order to resolve the water mass into sufficiently small portions to justify the assumption, made in laboratory experiments, of flow in plane layers. Even if this resolution of the complex motion into its elements were possible, there would still be the impracticable task of summing up the effects of the correspondingly complex and irregular system of forces in order to obtain the resultant effect. The only recourse is to observe the system as a whole under the actual conditions of the sea. For example, a decade ago, the Swedish physicist, V. W. Ekman, applied the classical hydrodynamical equations to certain ocean current observations, but replaced the viscosity coefficient by a constant representing the integrated effect of the complex system of frictional forces. The value of this constant is thousands of times greater than the coefficient of viscosity of sea-water. A generation ago, a German mathematician, Zöppritz, developed an elaborate mathematical theory of ocean currents, but used laboratory values of the physical constants. Consequently his theory disagreed widely with subsequent objective knowledge. Such results emphasize the fact that physical constants are dependent not only upon the nature of the substances, but also upon the corresponding external conditions, and must therefore be determined under the conditions prevailing where they are to be used.

Progress in laboratory investigations is continually demonstrating the variability of quantities originally regarded as physical constants. Further refinement often requires the substitution of a variable, dependent upon additional conditions, for constant quantities of earlier formulæ. This is also true in

cosmic and terrestrial physics. Continuous and highly refined observations on the sun have demonstrated the variable nature of the "solar constant." The so-called constants of heat conductivity, diffusion, viscosity, etc., pertaining to the ocean also vary with the conditions, though they are all thousands of times larger than the corresponding laboratory values.

For example, to determine the upwelling velocity in the southern California coastal region the author applied the classical equation[1] for the diffusion of salts in a medium moving with the velocity W, to seasonal observations of ocean salinities at a series of depths, and obtained the value 40 in C.G.S. units for the diffusion constant μ^2, while a Norwegian investigator, Jacobsen, obtained values varying from 0.3 to 11.4 for different regions of the sea near Denmark. The laboratory value for the diffusion coefficient of ocean salts in water is only .0000125. The upwelling velocity in the southern California region was also determined by applying to serial ocean temperatures Fourier's equation for the flow of heat in a moving medium. The conductivity constant for this ocean region was found to be 30, while the laboratory value of the coefficient of conductivity of sea-water is only .0012.

The values of such constants found under the simple conditions of laboratory control are known to depend upon the temperature of the fluid. This is in turn an index of the complex molecular activity. In the ocean, the corresponding variable factor is the rate of interchange of small parts of the water in the ever present alternating convective circulation.

Complicated as those phenomena are, encouraging results have already come from quantitative studies, not only in oceanography, but also in other geophysical investigations.

GEORGE F. MCEWEN
SCRIPPS INSTITUTION FOR BIOLOGICAL RESEARCH,
UNIVERSITY OF CALIFORNIA

[1] Ocean temperatures, their relation to solar radiation: quantitative comparisons of certain empirical results with those deduced by principles and methods of mathematical physics by George F. McEwen, 1919, Semicentennial Publications of the University of California, 1868–1918, pp. 336–421, 19 figs. in text.

THE DIFFERENTIAL STAINING OF PLANT PATHOGEN AND HOST

THE well-known difficulty experienced in staining to differentiate pathogen from host tissues in phytopathological studies needs no comment. In order to obviate this difficulty the writer has tried numerous combinations of stains and finally a method was hit upon which gives uniformly satisfactory results from the histological point of view. It is not intended for cytological studies although even for these there may be possibilities in the method.

The comparatively short time required to complete preparations, and the fact that students not yet expert in microtechnique can in most cases obtain good mounts, decided the question of publication.

STAINS

1. Magdala red. A 2 per cent. solution in 85 per cent alcohol.
2. Licht grün. A 2 per cent. solution in clove oil to which has been added a few drops of absolute alcohol.

METHOD

1. Dissolve paraffin in xylol and wash in absolute alcohol.
2. Wash in 95 per cent. and 85 per cent. alcohols.
3. Stain with Magdala red 5 to 10 minutes.
4. Remove surplus stain and wash in 95 per cent. alcohol.
5. Stain with Licht grün in clove oil for 1 to 3 minutes.
6. Wash in absolute alcohol, or in carbol-turpentine.
7. Clear in xylol and mount in Canada balsam.

The time factors may require slight modifications in some cases but a microscopic examination of the slide will enable the worker easily to determine the variation required. As a rule the staining with Licht grün is very rapid and if overstaining occurs the red becomes tinged with purple although this may

not impair the visibility of the mycelium. In completed preparations the mycelium, spores, amoebæ or bacteroidal tissues are a brilliant red and host tissues green. This combination gives clear differentiation for visual microscopic study but for photomicrography the use of filters is necessary.

If sections are somewhat resistant to staining good results are obtained by first mordaunting them in a 1 per cent. solution of potassium permanganate in water for 2 to 5 minutes, afterwards washing in water and passing through graded alcohols to 85 per cent. The mordant must be freshly prepared as it will not keep.

Excellent preparations have been obtained with the following phytopathological material: *Plasmodiophora brassicæ*, legume tubercles, *Albugo candida, Phytophthora infestans, Plasmopara viticola, Exoascus pruni, Mycosphaerella rubina, Venturia inaequalis, Cronartium ribicola, Peridermium balsameum, Uromyces caryophyllinus, Puccinia malvacearum, Puccinia antirrhini, Puccinia graminis*, etc.

It is hoped that others may find the method of some value.

B. T. Dickson

Macdonald College,
Quebec, Canada

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SECTION O—AGRICULTURE

The sessions of Section O, held in the Soldan High School, St. Louis, Mo., December 29 and 30th, 1919, were devoted to the discussion of the general subject: "The Relation of the Use of Power and Labor-saving Machinery to Agricultural Progress." For the sake of effective presentation, the general subject was considered in four of its important relations, namely, the influence of farm machinery on production, labor and wages; the influence of power and machinery on social and physical conditions surrounding farm life; the application of power to save labor; and future needs and developments.

In discussing the first of these topics, Mr. Arnold P. Yerkes, of the International Harvester Company, referred to the evolution of farm machinery and pointed out that the first real farm machine was invented less than half a century ago. Such farm tools and implements as were used a hundred years ago were of the one-piece variety and could not be properly designated as machines. They were very nearly identical with those that had been used by farmers for two or three thousand years. The invention of the reaper, in itself a rather simple machine, was quickly followed by other inventions represented by at least 100 distinct implements used on American farms at the present time. "During this period of invention and development of farm machines, American Agriculture has undergone a tremendous change. The old farming methods, which involved a great deal of hand labor, have given way for the most part to the use of machinery. An entirely new era of agriculture has been brought about and the new order has been made possible only through the invention of machines which reduced the amount of labor and the percentage of the population required to produce foodstuffs, thus enabling transportation and other industries to develop simultaneously with agriculture."

The invention and use of farm machinery has had at least two effects on labor. There has been a saving of labor by the increase in the efficiency of the individual and the consequent reduction in the number of men required to accomplish a given task. There has been, further, a substitution of animal and mechanical energy for human energy and the making of farm work less irksome and exhausting. For these reasons the employer of farm labor lays less stress than formerly on mere physical development and is willing to pay more for technical skill, initiative and manual expertness. "Incidentally these changes, brought about by the use of machinery, have resulted in a decided change in the type of farm hands upon American farms as whole. A few years ago immigrants who had had experience on the small farms in Europe made what were considered first-class farm hands, since they had a fair knowledge of a type of farming which did not differ materially from that found in this country. At that time many of the immigrants sought employment on farms in America and found it. But with the increased use of farm machinery this class of labor became less and less satisfactory because very few of the immigrants had any knowledge whatever of farm machinery, and, as many of them could not understand the English language, it was difficult to teach them. The practise of hiring these "green" immigrants therefore became less common."

Farm machinery, according to Mr. Yerkes, has not only increased the output per worker, but has made possible the more rapid extension of the cultivated area, and the increased production per acre thanks to the more thorough tillage of the soil and the more uniform methods of fertilization, planting and harvesting. On the whole, the use of farm machinery may be said to have increased the efficiency of man labor on American farms approximately eight times. In not a few instances the increase in man power efficiency has been even more striking. It should be remembered in this connection that the manufacture of machinery takes up a very considerable amount of labor, and that a certain allowance is to be made for it in calculating our labor resources.

"Notwithstanding the almost marvelous progress which has been made in less than a century in developing farm machinery of all kinds, there is every indication that the progress in the future seems likely to equal, if not surpass, that which has already been accomplished. It is realized that this may sound like an extravagant statement, nevertheless calm consideration of the whole subject must invariably lead one to the conclusion that this is entirely possible. Just as the invention of the reaper and its subsequent development produced a complete revolution in the methods of grain raising, so the invention and development of the internal combustion engine seems destined to work another revolution in general farming."

In his consideration of the second topic on the program Mr. F. W. Peck, of the Office of Farm Management, pointed out that farming differs from most of the other industrial pursuits in that it compels the performance of a relatively large amount of work in a limited space of time. In spite of the great range of conditions that one finds on American farms the question of labor efficiency is nearly always paramount. There is, therefore, an obvious relation of farm power to labor efficiency in American agriculture. The economic factors involved in the study of farm power relate to: (1) the requirements for power in farming; (2) the kind of power most readily available; (3) the form of power in its relation to man; (4) the influence of any given form of power on the organization and operation of the farm.

A study of the utilization of horse labor on three farms of different type showed that on a dairy farm in Wisconsin 6 horses were kept for 143 crop acres; on the Illinois corn and hog farm 9 horses were kept for 182 crop acres; and on the Iowa seed, grain and stock farm 12 horses were kept for 261 crop acres. Similar studies were conducted on large grain farms in North Dakota and Washington. In a general way it was found that on most farms hauling operations require more than half of all the horse power used; that plowing, harrowing and disking require from 15 per cent. on the small cotton and corn farm to 64 per cent. on the large Dakota grain farms. "It is safe to say that in most instances the seasonal and weather conditions limit the hours within which most operations must be performed, with the result that the work can not be expanded as might be desired."

In commenting on the same subject Mr. C. J. Galpin, of the office of Farm Management, said in his paper: "The machine is profoundly affecting the farmer's physical and mental life, as it is all human life. With every advance in machine power for the farmstead, both in the house and on the land, a shift occurs in the strain upon the farm family. Mechanical power takes more and more the brunt of gravity, and the big human muscle engine more and more falls into disuse, while the second series of finer, smaller muscle engines come more and more into play in farm work. . . . The machine-farmer becomes a new cerebral type, whose very struggle with the earth summons him to an employment of his hereditary intellectual mechanism, and a consequent intellectual life. Ever since the days of bits in the horse's mouth and reins to guide the horse, down to the present age of gas-driven tractor and motor car, the machine-farmer type has been in process of evolution. However, the hoe-farmer, both man and woman, can be found in every land, in every part of America, true to primitive type. Between these two types lies the mass of landworkers in the United States."

Under the topic "Application of Power to Save Labor" Mr. Wayne Dinsmore, secretary of the American Percheron Society, Chicago, Ill., contributed a discussion on "Animal Power"; Dean A. A. Potter, of the Kansas Agricultural College, on "Tractor Power" and Mr. Lee, of the Domestic Engineering Company, Dayton, Ohio, on "Electric Power." It was stated by Mr. Dinsmore that the mechanical motive power units in use in 1919 did not exceed 200,000. In other words, they had displaced but 2.2 per cent. of the horses and mules on the farms of the United States. According to the investigations of W. F. Handschin, of the University of Illinois, horses furnished the most economical source of farm motive power on all farms under 260 acres in area. But even on larger farms 75 per cent. of the work

could be done most economically by the use of horses. "Animal power is to-day our chief reliance in saving labor on farms, and so far as we can judge always will be. The more effective utilization of animal motive power units, and the application of labor saving methods therewith, should therefore receive especial consideration from our colleges, experiment stations and agricultural engineers."

The increasing of labor efficiency on the farm through the use of animal power involves the study of four leading factors: namely, the use of a greater number of horses per man; the application of more efficient methods in the use of animal power; the employment of more efficient types of horses; and the devising of new applications in utilizing animal power. It is worth while to note that the light two-horse teams used in New England plow scarcely more than one acre per day. In Pennsylvania and Ohio three-horse teams are often used and the acreage plowed by them will average two to two and a half per day. In Iowa and Illinois most farmers use four and five horse teams and plow four and a half to five acres per day; while in the PaLouse Country in Oregon, Washington and Idaho eight and ten horse teams are common and their performance is equivalent to eight to eight and a half acres per day. "To put the matter in another way, the men in the West were doing their work with half as much labor as Illinois' farmers and one eighth as much labor as New England farmers."

Dean Potter referred in his remarks to the part played by large scale production methods in the development of the American industries. These methods are, however, possible only where mechanical power and devices operated by mechanical power are available. In the use of horse power one man can control at most five or six power units, whereas in the use of mechanical power he can control many more units. A questionnaire sent out to Kansas farmers disclosed many interesting facts as to the cost of eparation, depreciation, efficiency of smaller and larger tractors, etc.

Considerable stress was laid by Mr. Lee on the opportunities that exist for using on the farm small electric motors of one half to three quarter horse power. Numerous tasks in the farm outbuildings and in the farm home could be performed by means of such motors, as for instance the operation of cream separators, sewing machines, pumps, vacuum cleaners, clippers, etc. Mr. Lee also referred to the need for investigation and training as bearing on the more effective use of labor-saving devices in the farm home, as well as in the outbuildings and on the land.

The last topic on the program, "Future Needs and Developments," was discussed by Mr. E. A. White, of the Holt Manufacturing Company, Peoria, Ill. Mr. White estimated that there are in use on the farms of the United States about 30 million horse power units made up of 16 million animal units, 5 million gasoline and kerosene tractor units, 4 million steam engine units and more than 3 million windmill and electric motor units. On the other hand, the manufacturing establishments of the United States control only about 18½ millions of mechanical horse power units. If nothing else, the magnitude of the agricultural industry demands the expansion in the use of animal and mechanical power where this would be warranted by economic conditions. It also demands a more intimate knowledge of the need for power, the efficient use of power and the improvement in the devices employed, as well as the training of the human agents to whom, in the last analysis, we must look for the effective use of both power and machinery.

At the business meeting Dr. E. W. Allen, chief of the Office of Experiment Stations, was nominated vice-president. The General Committee of the Association later confirmed this nomination. The other officers for the ensuing year are: Dr. A. F. Woods, retiring vice-president; Dr. A. C. True, member of council; Mr. George M. Rommel, member of general committee; Sectional Committee, Dr. C. P. Gillette (four years); Dr. John Lee Coulter (three years); Dr. A. F. Woods (two years); Dean Alfred Vivian (one year); Dr. Kenyon L. Butterfield (one year); Dr. J. G. Lipman, secretary (four years).

Jacob G. Lipman,
Secretary

SCIENCE

A Weekly Journal devoted to the Advancement of Science, publishing the official notices and proceedings of the American Association for the Advancement of Science

Published every Friday by

THE SCIENCE PRESS

LANCASTER, PA. GARRISON, N. Y.
NEW YORK, N. Y.

Entered in the post-office at Lancaster, Pa., as second class matter